



Caltrans Division of Research,  
Innovation and System Information

# Research Results

Maintenance

## NOVEMBER 2013

**Project Title:**

Hydrogen Fuel Cell-Powered Lighting  
Trailer Evaluation

**Task Number:** 2248

**Start Date:** January 2, 2011

**Completion Date:** September 30, 2013

**Product Category:** Evaluation of new  
commercial products to determine if they  
meet Caltrans needs

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## Using Hydrogen Fuel Cell-Powered Lighting Trailers for Night Work

*Evaluating the performance of hydrogen-powered generators in work zones*

### WHAT WAS THE NEED?

Caltrans and its contractors use diesel-powered trailers with metal halide lights for illumination during night work. The diesel units are noisy and have relatively high emissions. The lights also do not illuminate the area consistently and cause glare. The central area is brightly lit, but the light diminishes toward the periphery of the work area. If the lights are not carefully aimed in the work area to avoid the adjacent traveled way, drivers experience glare.

New hydrogen fuel cell-powered trailers with plasma or LED lights could be a beneficial replacement for the diesel-powered units. They are quiet, have zero emissions, provide better light distribution, and cause less glare for both nearby drivers and workers.

### WHAT WAS OUR GOAL?

The goal was to evaluate whether lighting trailers powered with hydrogen fuel cells are suitable for use in Caltrans work zones.

*Performing chain control using the hydrogen light trailer*



DRISI provides solutions and  
knowledge that improve  
California's transportation system.

## WHAT DID WE DO?

Caltrans, in partnership with the University of California, Davis Advanced Highway Maintenance and Construction Technology (AHMCT) Research Center, conducted numerous laboratory and field tests to evaluate how the hydrogen fuel cell trailers held up under different weather and transport conditions. The tested light tower was made available through a project funded by the Department of Energy Fuel Cell Technologies Office Market Transformation Program and Boeing.

Night field testing included guardrail repairs, bridge inspections, which require frequent moving of the trailer, mountain shoulder maintenance, and chain control operations in below-freezing temperatures. Maintenance requirements, refueling needs, and lifecycle costs were also examined. The initial tests used plasma lights, which proved to not withstand the vibration while transporting the trailer to and from work zones. The researchers then equipped the lighting trailer with LED lights, which performed well. The researchers evaluated all aspects of the light to see if they meet the quality and patterns required in work zones.

## WHAT WAS THE OUTCOME?

The hydrogen-powered system performed well in all field tests. Caltrans maintenance staff was able to operate the system after one brief training session. The unit equipped with LED lights exceeded the performance of the diesel trailers in the following areas:

- Ease of use from startup to shutdown during stationary and towing operations
- No need to wait for the lights to cool before lowering the tower, as is required for metal halide lights
- Longer use—fuel cell operates 100 or more hours compared to 40 hours for the diesel unit, especially if fewer than four LED lights were used
- Better light color and distribution
- No daily maintenance or preoperational checks required
- No monthly or other periodic oil or filter changes or engine tune-ups
- Low noise levels (43 dBA for the fuel cell versus 65dAB for the diesel engine), allowing workers to communicate with each other as well as better hear adjacent traffic, improving safety in the work zone

## WHAT IS THE BENEFIT?

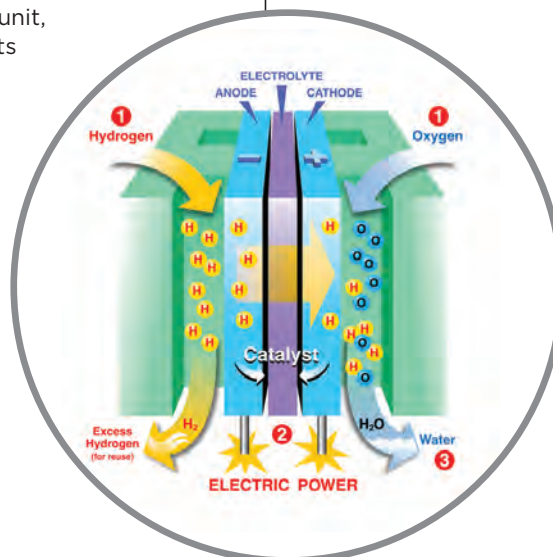
Compared to diesel, the hydrogen fuel cell-powered lighting trailer performs better and offers safer conditions for both workers and motorists. However, California currently has only five publically accessible hydrogen refueling stations. Mobile refueling is available, but is expensive. Hydrogen-powered trailers at this time are not practical, unless they are being operated near one of the hydrogen refueling stations. Due to the limited access to hydrogen fuel, it is recommended that Caltrans and its contractors continue to use diesel generators for lighting night work. Adopting hydrogen-powered trailers needs to wait until the availability of fueling stations increases.

## LEARN MORE

The final report will be available June 2014.



Night guard rail repair



Fuel cell operation